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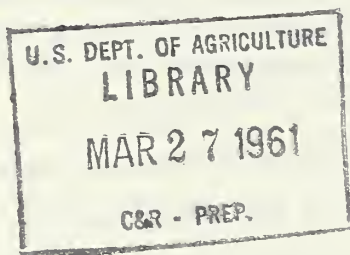
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# International Animal Feed Symposium

## LIVESTOCK FEEDING AND THE FEED INDUSTRY IN DENMARK\*

### FEEDING TECHNIQUE

Because labor in Denmark is very expensive it has been necessary to improve practices in the field of animal nutrition as well as other fields. Thus, endeavors have been made by introducing self-feeding and automatic watering systems, which to a certain extent can reduce the amount of manual work.

Efforts along these lines have been made to reduce the manual work connected with egg production. Hand feeding is still used, but the introduction of automatic water supply, deep floor litter, and manure troughs has greatly facilitated feeding.

In the production of broilers the feeding is often mechanized. The deep floor litter may be used for several consecutive groups of chickens. When in use the litter must be stirred frequently and between each consecutive group it must be made into stacks in which it will ferment. By the use of deep litter for several consecutive groups, the chicks will obtain the vitamins B<sub>2</sub> and B<sub>12</sub> from the litter.

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Very extensive arrangements for better insulation of broiler houses have been carried through, and producers of broilers have installed thermostatically controlled ventilation. These improvements have limited the influence of climatic conditions, and better utilization of the feed has been reported.

The National Research Laboratory has carried out experiments on pig feeding in free range conditions. The automatic feeding system applied in some of these experiments considerably reduced manual work. This feeding technique, however, is producing pig carcasses containing more fat.

The bacon from such pigs is not up to the required standard for quality.

In 1957 and 1958 the National Research Laboratory carried out five comparative group experiments with milking cows in free range conditions and in usual stables (stalls). In some of these experiments the free range stables were open, viz., the animals could freely move in and out of their stables all the time during the experiment. The average temperature was 8° to 10° C. lower in free range conditions than in the stables with stalls.

The experiments covered a period from November to May, or about 200 winter feeding days. The cows in the stable with stalls produced about 15 to 19 kilos of 4-percent milk per cow per day, whereas the corresponding animals in free range conditions produced 10 to 16 kilos of 4-percent milk per cow per day, i.e., about 20 percent less. Furthermore, utilization of fodder by the cows in free range conditions was reduced. When the free range stables were kept closed, the difference in feed utilization between the groups was diminished.

The requirements of straw as floor litter under free range conditions were 2 to 4 times greater than in stables with stalls. If automatic feeding is to come into wide use in Denmark, the economy in the amount of labor used in free range stables must be able to offset the increased expences caused by the smaller milk yield and the reduced utilization of the fodder.

#### **FEEDSTUFF EVALUATION AND POTENTIALS OF FEED UTILIZATION**

For about 30 years we have used in Denmark two different standards to characterize the nutritional value of feedstuffs, viz.

1. The feed unit content per 100 kilograms.
2. The content of digestible pure protein in percent, determined by the pepsin hydrochloric acid method.

#### **Energy**

*The feed unit*, also called the Scandinavian feed unit, is based upon the agreement of 1926 entered into between the Scandinavian countries.

The calculation of the feed unit content of a feedstuff is based upon a chemical analysis, the principles of which have been laid down by the Ministry of Agriculture, whereby the contents of crude protein, crude fat, nitrogen-free extracts, fiber, ash, and water are determined. The said methods of analysis are described in detail in *Working Methods for Chemical Examination of Milk and Dairy Produce, Feedstuffs as well as Fertilizers and Soil Improvement Agents*. The book has been published by the Ministry of Agriculture.

The values arrived at through such a feedstuff analysis for crude protein, crude fat, nitrogen-free extracts, and fiber must be multiplied by specific factors, and the product of these multiples gives the feed unit content per 100 kilograms of the article concerned.

Without going into details as to how the said factors have arisen, it should be mentioned that they are the results of thorough digestibility experiments designed to elucidate the nutritional value of the individual feedstuffs as compared with each other. In the past, a very considerable number of such digestibility experiments have been undertaken and the results are still being supplemented by new experiments. In Denmark, experiments of this kind are undertaken at the National Research Laboratory.

The feed unit content of a given feedstuff will thus be a combination of the chemical composition of the feedstuff itself and the values of digestibility, etc., previously determined through experiments with a feedstuff of the same kind and composition.

As there is now discussion as to whether the Scandinavian feed unit (f.u.) is still adequate, an explanation will be given here of the relation between the calculation of f.u. and starch value, and units which are identical with the starch value (fattening feed unit,  $NC_F$  unit, and oat unit).

When calculating the starch value (O. Kellner, 1851—1911), 1 kg. of starch is taken as the unit. This unit is measured by the quantity of fat that is deposited in full-grown animals (cows or oxen); 1 kg. of digestible starch deposits 248 g. fat, and 1 kg. of digestible fiber deposits 253 g. Usually a deposit of 250 g. fat is taken as being equal to 1 kg. of starch value. The energy nutritional value of the nutrients is measured in kg. of starch value and calculated thus :

$$\begin{aligned} & (\text{kg. digestible crude protein}) \times 0.94 \\ & + (\text{kg. digestible N-free extracts}) \times 1.0 \\ & + (\text{kg. digestible fiber}) \times 1.0 \\ & + (\text{kg. digestible crude fat}) \times 2.41 \quad (2.12 \text{ or } 1.91) \end{aligned}$$

The sum of the *kg. starch values* must be multiplied by the *value number* for

the given feedstuff, thereby obtaining the energy nutritional value of the feedstuff expressed in kg. starch value.

Calculation of the  $NC_F$  unit (H. Mollgaard) is identical with the calculation of starch value. The energy nutritional value is expressed in Calories, 1 kg. starch value (deposit of 250 g. fat) being equal to 2365 Calories of net energy or 2365  $NC_F$  units (deposit of 2365 Cal. with the fattening of full grown cows or oxen). When converting from kg. starch value to  $NC_F$  unit, we thus multiply by 2365.

The fattening feed unit (F.f.u.) is used in some of the Scandinavian countries (but not in Denmark). One F.f.u. is equal to 0.7 kg. starch value. When converting from kg. starch value to fattening feed units, we therefore multiply by 1.33.

In the U.S.S.R., Poland, and other East European countries, the oat is used as the unit. Calculation of the oat unit is identical with the calculation of starch values. One kg. of oats contains 0.6 kg. starch value. When converting from kg. starch value to oat units, we therefore multiply by 1.67.

The Scandinavian feed unit (f.u.) was originally based upon the nutritional value of 1 kg. of mixed grain as the unit (N.J.Fjord, 1825—1891); later upon 1 kg. of barley (N. Hansson, 1867—1945). The calculation of f.u. as it is done today, differs from the calculation of the starch value only in the factor for protein (using 1.43 instead of 0.94). When the factor 1.43 is used, the expression applied is *kg. milk production value* instead of kg. starch value. One f.u. (1 kg. barley) is equal to 0.75 kg. milk production value. When converting from kg. milk production value to f.u., we therefore multiply by 1.33

The only difference between the fattening feed unit (starch value,  $NC_F$  unit, oat unit) and the Scandinavian feed unit is that the factors of 0.94 and 1.43, respectively, are used for protein. The factor 1.43 was introduced by Nils Hansson on the grounds that the gross energy of the protein (5.7 Cal. per g.) is utilized to the same extent as that of the carbohydrates (4.0 Cal. per g.). When the value of the carbohydrates is set at 1, the value of the protein will consequently be equal to  $\frac{5.7}{4.0} = 1.43$ . However, the situation is that the utilization of the proteins will depend upon their use in the organism. Kellner's experiments showed that 40 percent of the gross energy of the proteins was utilized when producing fat. With oxidation in the organism, about 80 percent of the energy is released while the remainder is passed out of the animal in the urea (mammals) or uric acid (poultry). The quantities of protein that are deposited are utilized to the whole of their energy equivalents.



With a variation of the protein utilization, which varies from 2.2 Calories per g. (with fat deposits) to 5.7 Calories per g. (with protein deposits), a number of differing values could be obtained for energy utilization. These values will vary with the production in question and with the biological value of the proteins. Therefore, incorrect values will be obtained for the energy nutritional value. Protein values and energy values will be confused, unless special precautions are taken.

To avoid confusing protein and energy values, it is necessary to employ a procedure in which the protein quality will not exert any influence upon the determination of energy value. If experiments to determine the energy nutritional value are conducted under conditions where there is considerable synthesis of protein, the amino acid composition of the protein will decidedly affect the results obtained. Therefore, with such a procedure, a number of different—and incorrect—results could be obtained. The results will be wrong if they are to express the energy nutritional value. This may be understood to be *that part of the energy content of the feedstuff which is convertible into useful energy in the organism. The useful energy of a given feedstuff is that part of the energy which by intermediary transformation in the animal organism can be transferred to energy-rich bounds.* Upon the breakdown of these bonds, the energy stored is used for muscular work or synthesis.

Thus both theoretical considerations and fundamental research have shown that the value of proteins as energy suppliers is not 43 percent higher than the value of carbohydrates. Moreover, these things are so well known (excretion of urea and uric acid) that they will not be gone into any further here. When various researchers have argued throughout the years for a changeover to the fattening feed unit or systems of calculation identical with it (starch value,  $NC_F$ , oats unit), they have also done so on the grounds that the protein is overrated in the calculation of the Scandinavian feed unit.

There is some justification for stressing, in addition to the above, that it is not the useful energy (theoretical energy value) which is of interest, but the value with which the various groups of nutrients are utilized in the usual feeding of livestock. This argument is often put forward and it is even emphasized that the proteins are utilized to a far higher degree in deposits of protein than in fattening.

Against this argument the following can be stated :

1. *With a method for the determination of energy nutritional value,* however, it is necessary to exclude the special effect of the proteins. If this is not done, greatly differing values will be obtainable for the energy nutritional value of a protein-rich feedstuff because, as mentioned above, this will be

dependent upon the utilization of the proteins for protein synthesis. The extent of this synthesis will depend upon a number of different factors. If the special effect of proteins is to be avoided, the energy nutritional value must be determined under conditions in which the proteins are used for oxidation or synthesis of fat, or a correction must be made for deposited protein. Such a correction, i.e., correction to N-equilibrium, should always be undertaken when comparing the calculated with the directly determined, metabolizable energy.

2. *With calculating* the energy nutritional value, it will be possible to take account of that part of the proteins which is deposited. If 50 percent of the proteins is deposited, the ratio between the energy utilization of proteins and starch can be roughly calculated thus :

$$\frac{4.6+5.7}{2 \times 4.18} = 1.23$$

Reckoned in this way, the figure will correspond approximately to the ratio in which the energy of the two groups of nutrients will be utilized under ordinary conditions of feeding. The magnitude of the amounts of protein oxidized—in the example taken at 50 percent of the protein intake—will vary with the intake, the animal's physiological condition, and the biological value of the proteins. It must be remembered that the influence of the proteins on the total heat production of the animals (specific dynamic effect) makes it necessary to regard the above, as well as all other relative comparisons between proteins and other groups of nutrients, with some reservation. The above exposition shows that the factor of 1.43 given for the ratio between the energy values of proteins and carbohydrates is at any rate too high, while the factor 0.94 is probably too low.

### Protein

Feedstuffs are mostly bought in order to make up for the lack of proteins. Consequently the protein content of the purchased feedstuffs is of particular interest to the farmer, and in many cases it is this content which determines the value of the feedstuffs from the point of view of the consumer and thereby its commercial value.

Chemical examinations have long shown that the proteins are characteristic in that they contain a definite and rather constant quantity of nitrogen, viz., 16 percent.

The content of originally bound nitrogen is determined by a method originally discovered by the Danish chemist Kjeldahl, the principle of which is now used all over the world as a basis for protein determination.

The total content of originally bound nitrogen in a feedstuff multiplied by the quotient 100 divided by 16, i. e., 6.25, is called crude protein.

For two reasons, however, the crude protein content of a feedstuff is no reliable criterion of the value which the particular feedstuff has as a source of protein for the animals.

Part of what we include in the name crude protein is either building-up stages or breaking-down stages in the digestion of proteins—the so-called amides—and these substances cannot be assumed to be of the same importance to the animals as real proteins. As an example can be mentioned the break-down products which are formed when animal waste substances are allowed to remain undried. Thereby the protein is broken down, and a number of nitrogen compounds are formed, which will frequently be harmful and at best of doubtful nutritional value.

By the application of a special method, however, the so-called Stutzer-method, named after the German chemist of the same name, it is possible to remove the amides, and through nitrogen determination of the remainder by the Kjeldahl method the quantity of nitrogen is found which is present in the form of real protein, what we call pure protein.

In the amide content we have one reason why the crude protein content is no reliable criterion of its nutritional value.

The other reason depends upon the content of substances which are real proteins, it is true, but of such a kind that they cannot be broken down in the intestinal tracts of the animals, but pass out undigested with the manure.

Many examples of proteins of this kind may be mentioned. In this connection it would be most suitable to mention keratinized substances, which are almost invariably present in small quantities of bone-meat-meal, and which are quite indigestible. Another example is proteins which have been exposed to so much heat that the substance is burnt. The consequence will always be that the protein is transformed and becomes indigestible.

To determine the content of such substances we apply in Denmark the so-called pepsin hydrochloric acid method, the principle of which is to initiate the processes which take place in the alimentary canal.

A quantity of given weight of the substance to be examined is stirred up in water. To this are added a definite concentration of the enzyme pepsin and a certain quantity of hydrochloric acid. This mixture is placed in a thermostat of 37° C for 48 hours under frequent stirring. When the 48 hours have passed, it is assumed that the pepsin has broken down all the proteins which could be broken down in an animal stomach, and as the split proteins are soluble in water in contrast to those which have not been broken down, it is possible by filtration and rinsing to retain the undigested protein compounds, the protein content of which is then determined.



The content of pure protein less the content of indigestible protein gives the content of digestible pure protein.

Applied to feedstuffs with a low fiber content, as in the case with most feedstuffs on the market, the method gives results that are so near those arrived at by digestibility experiments that the method must be said to be a reliable and useful guide to consumers with regard to the protein value of the feedstuffs.

Some circumstances in relation to animal nutrition in Denmark seem to indicate an advantage in using digestible crude protein instead of digestible pure protein.

Work will be carried out in order to show whether such a change would be beneficial. In this connection, a strong argument to be considered is that such a change would put Denmark in line with most other countries. From the point of view of feedstuff control, digestible crude protein is not considered an acceptable expression of the nutritional value of proteins. Work will also be carried out to estimate the content of amino acids in Danish foodstuffs.

In the feeding year 1957-58, Denmark imported about 623,000 metric tons of oilcakes and meals and other feedstuffs. The Danish feed industry also bought about 95,000 tons of Danish-made oilcakes and meals. The feed trade further absorbed about 45,000 tons of domestic meatmeal and bonemeal, and about 85,000 to 90,000 tons of milling byproducts such as wheat bran, pollards, etc.

Under "other feedstuffs" is included imported fishmeal. Danish production of fishmeal amounted to 50,000 to 60,000 tons, of which 80 to 85 percent were exported.

In the same period, grain imports amounted to 729,000 tons, while 474,000 tons (mostly malting barley) were exported. The Danish grain crop in 1957 was 4,761,000 tons.

Except for the grain, of which a good part was sold as whole grain, the overwhelming majority of these quantities was sold as industrially manufactured compounds.

As of March 15 this year (1959), imports since June 1, 1958, amounted to 738,000 tons of oilcakes and other feedstuffs and 863,000 tons of grain. Grain exports were 297,000 tons. Available for the feed man were a further 148,000 tons of domestic oilcakes and meals, about 42,000 tons of domestic meatmeal and bonemeal, 89,000 to 90,000 tons of Danish mill offals, and 10,000 to 12,000 tons of Danish fishmeal (export deducted).

The crop of homegrown grain in 1958 is estimated at about 4,480,000 tons.



These figures give a picture of the quantities of feed that go into the feed business in some way or other. But in addition, vast quantities of roughage, etc. are used as feed without passing the feed store. As Denmark has a population of only about 4,500,000 inhabitants, the feed tonnage is substantial.

As there are no subsidies, agriculture must rely fully on itself. The problem is not so much production, but rather outlets. The end products meet keen competition from producers in other countries who work with heavy subsidies from the taxpayers. The Danish farmer has shown that he can compete with anybody, as long as they produce on even terms. He can offer products of the highest quality too.

But won't he be able to utilize much larger quantities of feed, then ?

Well, for the time being it would seem that the demand is about saturated.

The Danish people's diet is of a high nutritional value and is—in comparison with most other countries—on the luxury level. Therefore, no expansion in food sales worth mentioning is to be expected on the home market. As incomes grow larger, consumers will spend the increase on automobiles, televisions, refrigerators, and such things—hardly on food, of which they get enough on their present income.

Changes in eating habits will occur, of course; for example, it is safe to predict that there will be an increasing demand for poultry meat, but although the broiler industry is growing fast, it will be a long time before poultry meat can compete with pork on a price basis. In consequence, the import pattern will change, but it will hardly lead to important changes in feed utilization.

As far as foreign markets are concerned, the future is more uncertain. We know that an alarmingly large part of the world's population does not get enough to eat, and we know that the population is growing at an ever-accelerating speed. Consequently we know that there is, and will still be, a great unsaturated demand for food—and therefore also for feed. As under-developed areas are progressing, their eating habits are shifting from vegetable foods, like bread, to animal foods.

Whether the Danish farmer—and the Danish feed manufacturer—will get his share of this expanding market will depend to a large extent on the agricultural policy of other countries. The desire of most countries to become self-sufficient as protection in time of emergency is strong and is forcing unremunerative production of food products which other countries could produce—and make a living on it.

Most of this production is based on imported feed, and it is hard to see why it should be easier in times of emergency to import, say three tons of feed than one ton of meat.

As, however, the more developed part of the world also will reach a higher standard of living, there will be an increasing demand for high-quality food, and this is the Danish farmer's chance. For this reason it is not too optimistic to predict a growth in feed consumption.

Part of this expansion in feed consumption will be covered by domestic feed, however. For many years there has been an ever increasing output per acre, and there will still be for some time to come. Also production of commodities like fish meal has been growing rapidly.

It must be stressed, though, that it is extremely difficult to give a reliable answer to this question, because so much depends on politics. Danish food exports have met with much opposition these last years, and unfortunately there is no reason to believe that this will not happen in the years to come, too.

Another question is whether the new nations are able to pay for their food imports. Denmark has found that this is a real problem. Exports to Eastern Europe and the Soviet Union have not come up to expectations, simply because it has not been possible to find products which the buyers can offer in return in the necessary quantity and quality. Thus, sales are made on credit, and there is a narrow limit for the quantity a small country can sell on such terms.

As food sales and feed sales are closely interconnected, it will be seen that predictions about feed consumption and feed utilization must be made with great prudence, when the predictions concern a country which already has a very important export of food.

### **FEED MANUFACTURING**

While compound feeds have been sold in Denmark for a great many years, it must be admitted that several plants are still old-fashioned.

During the last 10 years, however, many plants have been modernized and several new plants erected.

The main part of the cattle food compounds are produced by the "old process." The system is well known: The various ingredients are filled on bins from which they are "drawn" in the proportions desired, based on their specific gravity. From the bins the material flows into a horizontal tube in which they are mixed by a screw. Minerals, etc. are usually pre-mixed to insure even distribution.

From the screw mixer the mixture passes over a rotating sieve, where the dust is separated, to the pellet mill and cooler, and from there again over the sieve to a screw mixer where molasses is sprayed into the mixture.

The goods are tapped through an automatic scale and bagged, either into ordinary paper bags which are closed by binding or by sewing, or filled into valve bags through a packing unit. Considerable quantities are sold in jute bags, which are rented free for a fortnight (net weight).

This "old process" mixing predominates today. However, several plants are using a newer principle. Under the bins with the raw materials is a battery of scales which automatically weigh the amount of each ingredient required, based on its specific gravity.

New plants that will operate on a different principle are under construction. The ingredients are conveyed from the storage bins to special mixing bins, under which is located one central scale. At the bottom of the mixing bins are feeder scales which are operated automatically by punchcards from a control board to allow the exact quantity of each ingredient for a mixture of 1,000 kg. to flow into the central scale. When the scale is filled with 1,000 kg. it is automatically emptied into the mixer, where the ingredients are mixed, while the central scale is being filled again. After mixing, the goods pass over magnet and sieve and are conveyed by pneumatic transport to pellet mill or crumbler.

The filling of the mixing bins is automatic and is operated from a control board.

From packing units the mixture goes to pallets, 15 bags on each, and from there to a roller conveyor, from where they go on a fork truck.

Poultry feeds are mainly produced in plants like the above-mentioned "old process" plants, but with feeder scales; but new plants are being constructed after the central scale principle.

Usual ingredients of *cattle feeds* are cottonseed cakes, sunflowerseed cakes, peanut cakes, linseed cakes, copra cakes, soybean meal, molasses, and minerals. Also some rapeseed cakes and palmkernel cakes are used.

To secure a high iodine value flax is often added, or, when price relations make it advantageous, soybeans and linseed cakes.

While the formulas are basically uniform, some deviations occur from one locality to another. Generally, however, cottonseed cakes represent 40 to 50 percent of the formula.

The quality formula feeds are made from non-extracted cakes/expellers only,



or, in some instances, with a maximum of 5 to 10 percent of high-quality soybean meal. Most manufacturers, however, also produce a secondary mixture with a higher percentage of extracted meals, and, unfortunately, there are—as everywhere—some manufacturers who only produce inferior quality.

For *poultry feeds* the most widely used ingredients are corn, milo corn, barley, oats, wheat, soybean meal, meatmeal and bone meal, fishmeal, dehydrated alfalfa meal, dried yeast, minerals, and vitamins—and in some cases, molasses and animal fat.

### RESTRICTIVE REGULATIONS

Sources of current feedstuff regulations are :

Main Act : Act No. 135/1939 relating to trade in livestock feeds, fertilisers and soil amendments.—13 April 1938.

Amplified by the Acts Nos. 288 of 30 May 1940 and No. 161 of 24 May 1955.

Regulations (basic) No. 234 relating to trade in livestock feeds, fertilisers and soil amendments.—24 June 1939.

Amplified by the following Regulations from the Ministry of Agriculture, dated : 16 July 1941, 27 March 1946, 3 November 1948, 17 September 1949, 2 October 1950, 26 September 1952, 12 May 1953, and 13 March 1958 (on medicinal additives).

Definition of livestock feeds.—“By livestock feeds (Foderstoffer) under this Act there shall be understood all kinds of feed concentrates as well as all technically or industrially treated organic or inorganic substances or mixtures of such substances used for feeding purposes, excepting however unmilled grain and seed as well as feeds obtained as by-products from Danish industry—but not including grain or oil mills—without having undergone further technical treatment such as evaporation, desiccation or pulverization.

Products offered for sale as containing vitamins for use as livestock feed are at all times subject to the provisions of this Act.”

The feedstuff purchasers are protected by (1) the voluntary control of the Government Feedstuff Control, and (2) the Feedstuff Act and the supervision of the observance of the Act.

The voluntary control.—The voluntary feedstuff control began its activities in the middle of the 1920's and initially included quite a few factories. What



characterizes the voluntary feedstuff control is the very fact that it is voluntary. It is primarily concerned with feedstuffs used in agriculture.

Firms registered at the voluntary feedstuff control are liable to guarantee the contents of digestible pure protein and feed units (*Scandinavian feed units*)—and in certain cases the content of crude fat—in the feedstuffs manufactured under the supervision of the feedstuff control.

The registered firms can obtain permission to use certain common marks protected by law. The idea of these marks is that when consumers buy such marked feed mixtures, they are sure of obtaining mixtures of a certain standard and suitable for a definite purpose.

Traveling inspectors of the Government Feedstuff Control are constantly drawing samples of feedstuffs from all over the country. When samples are drawn, they are analyzed chemically for crude protein, crude fat, and other contents; the contents of digestible pure protein are also determined. On the basis of the chemical analysis the content of feed units per 100 kg. is determined. The samples are also subjected to a microscopic-botanical examination, the purpose of which is to show the type and quality of the feedstuff, keeping condition, and possible presence of poisonous seeds. In the case of mixtures, it is furthermore ascertained whether the mixture proportions are as stated, just as it is ascertained—if necessary supported by chemical analysis of sorted ingredients—whether the quality of the feedstuffs used is in agreement with the statements.

The feedstuff control sends the results of the samples analyzed to the places at which samples have been drawn and to the manufacturers of the feedstuffs concerned, and if it appears that a lot does not come up to guarantee, purchasers are notified of the steps they will have to take in order to obtain the compensation which is due them according to the rules of the feedstuff control. Such notifications are sent to the purchasers of every deficient lot, as according to rules registered firms are liable to pay compensation for all that has been sold of the lot.

Furthermore, through applications to the feedstuff control and buyer of feedstuffs manufactured under the supervision of the voluntary feedstuff control may obtain, free of charge, analyses of analyzed samples, if the buyer informs the feedstuff control of the name of the factory concerned and the name and lot mark of the feedstuff.

**The feedstuff Act.**—Whereas the voluntary feedstuff control is concerned only with the supervision of feed mixtures and animal feedstuffs, the feedstuff act includes all marketed feedstuffs in general, irrespective of whether they are

sold in pure condition or in mixture, and irrespective of whether they be of organic or inorganic substances. Grain, whether ground or unground, is not included in the act.

By provisions of the act the Minister of Agriculture is authorized to make special designations for feedstuffs, and in cases where such designations have been made, only these may be used.

The provisions of the act concerning feed mixtures are considerably more far-reaching in general than those which apply to unmixed feedstuffs, primarily in that feed mixtures must only be delivered by the manufacturer in sealed bags provided with guarantee markings stating the name and address of the manufacturers and the exact composition of the mixture, time of manufacture, and the animals for which the mixture is intended.

The act also provides that if a feedstuff or a feed supplement is said to contain vitamins, a guarantee must be extended as to the kind and quality of vitamins per gram of the finished product.

Special rules must be observed for admixture of medical compounds in feedstuffs. Only medical preparations for which special permission has been obtained from the Ministry of Agriculture may be added to feedstuffs. Such preparations may only be sold in packets approved of by the Ministry of Agriculture. Detailed information concerning the contents and directions for use must be clearly stated on the outside of the packets.

Results obtained from the analyses of samples which the feedstuff control draws to ensure that the provisions of the feedstuff act have been observed — partly the ordinary inspection and partly the special inspection in cases where medical preparation have been added — are solely at the disposal of the Ministry of Agriculture.

If the examinations undertaken by the feedstuff control show that the samples concerned do not correspond to the information given, the feedstuff control reports it to an inspection committee appointed by the Ministry of Agriculture. This committee estimates the magnitude of the infringements and makes recommendations to the Ministry of Agriculture, which then gives the responsible parties warnings and imposes fines on them for the infringements ascertained.

The significance of the existing feedstuff act to consumers lies primarily in the fact that the seller is under obligation to state various particulars of sold and offered feedstuffs, which enable the buyer to form a reliable opinion of the type and nature of the goods offered and consequently of their value.

To ascertain whether the information given by the seller is correct, each buyer is entitled to have an analysis made of the feedstuffs which he has bought. The act contains special provisions to the effect, and special rules have been laid down with regard to the drawing and examination of such samples.

The expenses arising from such examinations are to be defrayed by the seller, if it appears that the quality of the feedstuff examined falls short of what has been stated by the seller. Otherwise the buyer has to defray the expenses.

## MARKETING

The figures given elsewhere in this report will show that in comparison with the size of the country, the feed industry holds an important place in Danish economic life. The tonnage is considerable and the feedmen feels the lack of hedging facilities.

As the major part of the compounds consists of imported ingredients, the feed manufacturer is forced to buy ahead, and he has usually heavy quantities on hand. Of course he is also selling ahead, but as his sales for forward delivery are much smaller than his spot sales, his position is always long.

Profits are small—considering the risk, ridiculously small—but the competition is very keen and leaves no greater profit possibilities.

About 52 to 53 percent of the turnover is in the hands of the cooperatives.

The profit margin on the manufacturing is so small that it gives almost nothing. Actually, the feed manufacturer is more a trader than a manufacturer; at least he has to make his profit on the fluctuations of the market.

In these circumstances it will be understood that the lack of efficient hedging facilities is a serious problem to the industry.

The Danish feedman may of course operate in the future markets in the United States and in England, and he sometimes does so, but it is obvious that he cannot possess the information and knowledge that is available to people of the countries in question.

When he avails himself of the facilities of futures markets, it is practically always on the grain exchanges he operates and seldom, if ever, on the protein meal exchanges. One may then ask, why futures markets are not established. The answer is that the market is too narrow. Manipulations would be too easy.

A problem which has marketing, legislative, and technological aspects is transportation.



All road and railway transport of feeds is, so to speak, in bags. All compounds are sold in bags, mostly paper bags. The cost of paper bags or other bags is high, and getting rid of the bags is a problem for many farmers. Therefore the idea of selling feed in bulk has been under consideration for some time, but so far without a result.

As most compounds are sold through smaller retail dealers whose stock-carrying capacity is based on bagged goods, heavy investments on the part of retailers are involved. They will have to build special bins and to buy bulk trucks of some kind.

The importer and feed manufacturer (usually the same firm) must construct special bins because the material is of uneven weight, and on emptying the bins it has been ascertained that the mixture is no longer homogeneous. What happens is of course the same as when a grain bin is emptied. The heavy material flows out first, and the lighter parts come out last.

At least one machine manufacturer now says that he has solved this problem, and a few plants are now under construction. None of them have been completed, so we have no experience with these plants in Denmark so far.

Provided the constructor can keep his promise, the cattle compounds can be stored in bulk, but not yet sold in bulk. In addition to the transportation problems and the possible risk of separation during transport, the problem in the retail link and on the farm, there are also troubles of legislative nature.

The Danish feedstuff law has been dealt with elsewhere in this report. It will be seen that delivery of compounds in bulk involves several problems as to declaration, control, and other matters. Although it should be possible to find a solution to these problems, it will no doubt take time to find a way out which can satisfy the legislators.

Integration is not yet of any importance in the Danish feed industry. A start has been made in the broiler industry and further development is expected in this field, but integration will hardly spread to other lines of agriculture in the near future. With few exceptions, Danish farms are small-many are very small-and for political reasons small farms are still being established. The Danish feed manufacturer's customer is still an independent operator.





